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# First cannabis use: does onset shift to younger ages? Findings from 1988 to 2003 from the Dutch National School Survey on Substance Use

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## ABSTRACT

**Aims** To investigate the hypothesis that changes in cannabis prevalence among Dutch secondary school students (aged 12–17 years) were paralleled by shifts in the age of first cannabis use.

**Design and participants** Data were derived from five waves (1988, 1992, 1996, 1999 and 2003) of the Dutch National School Survey on Substance Use, a nationally representative cross-sectional study, with a total of 32 777 respondents.

**Measurements** Written questionnaires on cannabis, tobacco, alcohol, other drug use and socio-demographic and behavioural variables were administered in classroom settings.

**Findings** Survival analysis showed a strong increase in cumulative incidences by age of first cannabis use from 1988 to 1992, a further increase in 1996 and stabilization in 1999, continuing into 2003. From 1992 to 1996, age of onset shifted towards younger ages. Onset peaked at age 15 in 1992 and age 14 in 1996. The proportion of life-time cannabis users starting at age 13 or younger increased from 26% in 1992 to 41% in 1996. The overall trend was similar for boys and girls.

**Conclusions** The study largely confirmed the expectation that the increase in cannabis use from 1988 to 1996 was paralleled by a decrease in the age of first cannabis use. From 1996 to 2003 age of first cannabis use and prevalence stabilized, possibly occasioned by a change in cannabis policy in the mid-1990s.

**KEYWORDS** Age of onset, cannabis use, secondary school students, trends.

## INTRODUCTION

The use of cannabis has long been considered relatively harmless. However, recently concern has been growing about possible adverse health effects, both physical (Ash-ton 2001) and mental (Court 1998; Arsenaault *et al.* 2002; Patton *et al.* 2002; Rey *et al.* 2002; Van Os *et al.* 2002; Zammit *et al.* 2002; Boys *et al.* 2003; Fergusson, Horwood & Swain-Campbell 2003; Henquet *et al.* 2005; Smit, Bolier & Cuijpers 2004). The adverse health effects appear to be most pronounced among those who start using cannabis at a young age (before 16) (Arsenaault

*et al.* 2002; Fergusson *et al.* 2002a, b; Stefanis *et al.* 2004), the biological plausibility of which is supported by research suggesting that cannabis use may result in long-lasting neurobiological changes during sensitive periods of brain development (Ehrenreich *et al.* 1999; Pistis *et al.* 2004). Furthermore, an early age of onset is found to be associated with heavy or even problematic cannabis or other drug use at a later age (Grant & Dawson 1998; Lynskey *et al.* 2003). Early users are also less likely to quit their habit than those beginning at later ages (DeWit, Offord & Wong 1997). The early adolescent years thus seem to be a crucially important period for the



development of cannabis-related harm. Although the association between early cannabis use and subsequent problems may be due in part to common risk factors (Degenhardt *et al.* 2003) it remains nevertheless important, from a public health perspective, to monitor age of onset closely, as a decreasing age of first cannabis use is likely to result in a higher cumulative life-course exposure.

Data from the European School Survey project on Alcohol and Other Drugs (ESPAD) show that the Netherlands occupies a middle position when cannabis prevalence rates are compared across European countries (Hibell *et al.* 2004). However, the ESPAD data also indicate that the Netherlands is among the countries with the largest proportion of students (8%) who started using cannabis at age 13 or younger (Hibell *et al.* 2004). The highest proportion of early starters is found in the United Kingdom and the United States (14% and 13%, respectively).

World-wide, only a few studies have been conducted on changes in the age of first cannabis use (Dennis *et al.* 2002; Kraus & Augustin 2002; Müller & Gmel 2002; EMCDDA 2004), and in the Netherlands no such study has been carried out before. However, the Dutch situation may present an interesting case for two reasons. First, changes in the prevalence of cannabis use have been observed over time (Monshouwer *et al.* 2004). To be more specific, trends in cannabis prevalence among Dutch adolescents showed a substantial increase between 1988 and 1996. These changes may reflect underlying shifts in the age of first cannabis use, in particular a parallel lowering of the age of first use. Secondly, the trend in cannabis prevalence subsequently stabilized after 1996 up to 2003, which may be attributed partly to the fact that in the Netherlands in 1996 cannabis-related policies changed. At that time, the legal age for buying cannabis in 'coffee shops' was raised from 16 to 18 years. This may have had an upward effect on the age of first cannabis use or may have countered the trend of a decreasing age of first cannabis use after 1996.

Using survey data from 1988 to 2003, the following research question was addressed in this study: does age of first cannabis use follow a similar trend as prevalence, i.e. (1) was the increase in prevalence from 1988 to 1996 paralleled by a decreasing age of first cannabis use? (2) Was the stabilization in cannabis use prevalence starting in 1996 followed by a break in the decreasing trend in age of first cannabis use?

## METHODS

### Sample

The data were derived from the ongoing Dutch National School Survey on Substance Use among students aged

12–18 years, conducted every 4 years since 1984. The 1984 data could not be used because no question on the age of first cannabis use was included. The samples of the 1988, 1992, 1996 and 1999 studies were obtained in the following way. First, all Regional Health Services in the Netherlands were requested to participate in the study. At every wave, at least half of these Health Services agreed to collaborate. Secondly, within each region, school classes were stratified according to school type (five types) and grade (ranging from four to six, depending on the school type). Classes were drawn proportionately to their number in the region. Thirdly, within classes all students were drawn as a single cluster. In 2003, a two-stage random sampling procedure was used. First, schools were stratified according to level of urbanization. Secondly, schools were drawn proportionally to their number in the corresponding urbanization level. Thirdly, within each school, a maximum of five classes (depending on school size) were selected randomly from a list of all classes provided by each participating school. Fourthly, within classes all students were drawn as a single cluster. These procedures resulted in samples of 4562, 6900, 6731, 6860 and 7724 students from secondary schools (aged 12–17, mean age 14 years) in the respective waves, with a sum total of 32 777 students. The participation rates within classes were high, with an average of 95%. To make it possible to compare results across the waves and to generalize the results to the general school-going population of this age, a weighting procedure was applied. Post-stratification weights were calculated by comparing the joint sample distributions and known population distributions of school type, grade and level of urbanization (the latter only in 1999 and 2003) of the corresponding year (the national statistics were obtained from Statistics Netherlands). The 1988, 1992 and 1996 data sets could not be weighted for level of urbanization. To investigate if this could possibly affect our results, additional analyses were performed. Using the 1999 and 2003 data sets Cox regression analysis showed that, while controlling for school type and grade, there was only a weak and non-significant ( $P > 0.05$ ) relationship between age of first cannabis use and level of urbanization. Because of these small and non-significant effects, it is assumed that weighting the data sets of 1999 and 2003 on level of urbanization has had little effect and will not have influenced the results in any meaningful way.

### Data collection

All data were collected by questionnaire, distributed in classes and administered by staff of the Regional Health Services during a regular lesson (usually 50 minutes). All administrators were instructed to use the standard introduction text as provided. Administrators also received



written instructions and guidelines on how to answer questions from students completing the questionnaire. The administrators stressed the anonymity of the respondents when presenting the questionnaire. Anonymity was further secured by providing the students with stickers to seal their questionnaire and by asking teachers to leave, or to take a place at the back of the classroom. The questionnaire included questions on substance use (alcohol, tobacco, cannabis, ecstasy, cocaine, heroin, magic mushrooms), socio-demographics (e.g. ethnicity, urbanization level), family (e.g. family structure, parental substance use), peers (perceived substance use among peers) and behavioural variables (e.g. delinquency, school performance). The questionnaire was improved and updated for every wave, but the core questions used in this paper, including the question on age of onset of cannabis use, remained unchanged.

### Measures

The question 'Have you ever used weed or hashish' identified life-time cannabis users. Students could answer by ticking off the number of times they had used cannabis (categories: 0/1/2/3/4/5/6/7/8/9/10/11–19/20–39/40 times or more). Answers were recoded, resulting in two categories: 'never used' and 'used one time or more'. The age of onset of cannabis use was based on the question 'How old were you when you tried weed or hashish for the first time?'.

### Analysis

Two characteristics of the data needed to be taken into account in the analysis. First, students from the same school were drawn as a cluster. A cluster sample will not affect point estimates, such as prevalence rates and hazard rates, but it does affect variance-related estimates, such as sample errors, 95% confidence intervals (95% CIs) and *P*-values. Secondly, weights had to be applied. In order to obtain correct 95% CIs and *P*-values in a reweighted and clustered sample, robust standard errors were obtained by means of the Huber/White/sandwich method as implemented in Stata (Stata Corporation 2001).

Analyses included prevalence estimates for life-time and 4-week use in 1988, 1992, 1996, 1999 and 2003. Shifts in age of onset of cannabis use were evaluated in two ways. First, cumulative incidences were estimated and presented as a function of age. In this analysis, data from all respondents were included. This means that there were right-censored observations, because some respondents had not experienced the event of interest (first cannabis use) by the time of the interview. Therefore, Kaplan–Meier survival analysis was used,

a technique that takes censoring into account. Secondly, among the 'life-time cannabis users' the distribution of age of first cannabis use was calculated, and differences in the starting age between the respective waves were tested using linear regression. All tests were conducted two-sided at  $P < 0.05$ .

## RESULTS

### Prevalence of cannabis use from 1988 to 2003

There was a marked increase in the life-time and 4-week prevalence rates between 1988 and 1992 in the age group of 12–17-year-olds (Table 1). The rate of increase was similar for boys and girls. Levels increased further from 1992 to 1996. In 1999 rates stabilized, continuing in 2003 when the overall life-time and 4-week prevalence were 18% and 8%, respectively. The prevalence for girls was significantly lower than for boys (except for life-time prevalence in 1988 and 2003). However, from 1999 to 2003 boys and girls showed opposite trends, with prevalence rates dropping slightly among the boys while a small increase was observed among the girls. Consequently, in 2003 differences between boys and girls had dwindled and were even non-significant for life-time prevalence.

### Cumulative incidence from 1988 to 2003

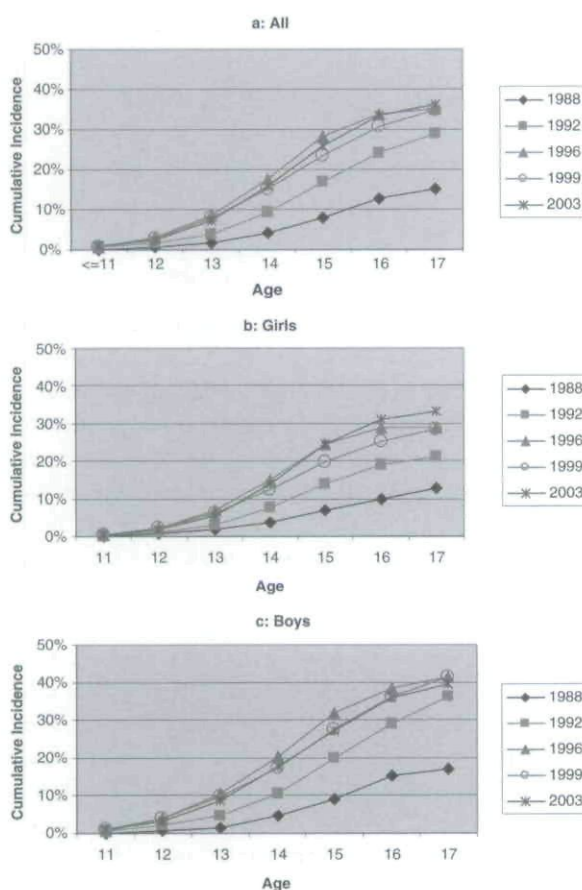
The curves presented in Fig. 1 yield information on two aspects of the relationship between age and first cannabis use. First, the level of the curve at a given age indicates the percentage of students that have used cannabis at least once by that age. A comparison of the five waves (Fig. 1a: all students) shows that at all ages, the cumulative incidence was lowest in 1988. The curves of 1996, 1999 and 2003 showed marked overlap; differences were only significant at ages 14 and 15 years, with cumulative incidences being higher in 1996 compared to 1999. The 1992 curve was between 1988 and 1996/1999/2003. All differences between the curves of 1988, 1992 and 1996 were significant except for the difference between 1992 and 1996 at age 11 years. From these results it can be concluded that the increase in life-time prevalence from 1988/1992 to 1996 (Table 1) is the result of an increase in first cannabis use at every age. For example, the proportion of students having used cannabis by age 13 years increased from 2% in 1988 to 4% in 1992 and 9% in 1996 (stabilizing at 8% in 1999 and 7% in 2003). At age 16 years these percentages were 13 (1988), 24 (1992), 34 (1996), 31 (1999) and 33 (2003).

The second aspect concerns the slope of the curve, giving an indication of the cannabis use incidence rate during a certain age-interval (the steeper, the faster). A

**Table 1** Life-time and 4-week prevalence with 95% confidence interval (95% CI) in 1988, 1992, 1996, 1999 and 2003 among secondary school students aged 12–17 years, by sex (in percentage).

	Girls		Boys		All	
	%	95% CI	%	95% CI	%	95% CI
Life-time prevalence						
1988	6.1	5.0–7.4	8.2	6.5–10.4	7.2	6.0–8.6
1992	11.0	9.4–12.9*	17.1	15.3–19.1*	14.1	12.7–15.7*
1996	17.3	15.1–19.7*	24.3	21.6–27.2*	20.8	18.7–23.1*
1999	15.4	13.5–17.5	22.3	20.2–24.6	18.8	17.1–20.6
2003	16.7	14.6–19.1	19.3	17.1–21.7	18.0	16.2–20.0
4-week prevalence						
1988	2.3	1.8–3.1	4.3	3.3–5.5	3.3	2.7–4.0
1992	4.1	3.4–5.0*	8.7	7.5–10.2*	6.5	5.6–7.4*
1996	7.8	6.4–9.6*	13.7	11.7–16.1*	10.8	9.4–12.4*
1999	6.5	5.2–8.1	11.9	10.0–14.0	9.1	7.7–10.7
2003	6.9	5.7–8.3	9.6	8.5–10.8	8.3	7.4–9.2

\*Significant difference compared to the previous survey.

**Figure 1** Cumulative incidence by age of first cannabis use in 1988, 1992, 1996, 1999 and 2003. (a) all students; (b) girls; (c) boys

comparison of the shape of the five curves can give two outcomes: first, parallel curves, pointing to a proportional increase in cumulative incidence, i.e. there is no shift in age of first cannabis use; and secondly, the slopes

differ across the waves, indicating that the increase (or decrease) in new cannabis users was more (or less) marked in that age span, thereby indicating a shift in age of onset. From a visual inspection, the curves of 2003, 1999, 1996 and, to a lesser extent, 1992 seem steeper than 1988, especially at the younger ages (< 15 years) (Fig. 1a: all students). This finding points to a shift towards younger ages (see below for further results).

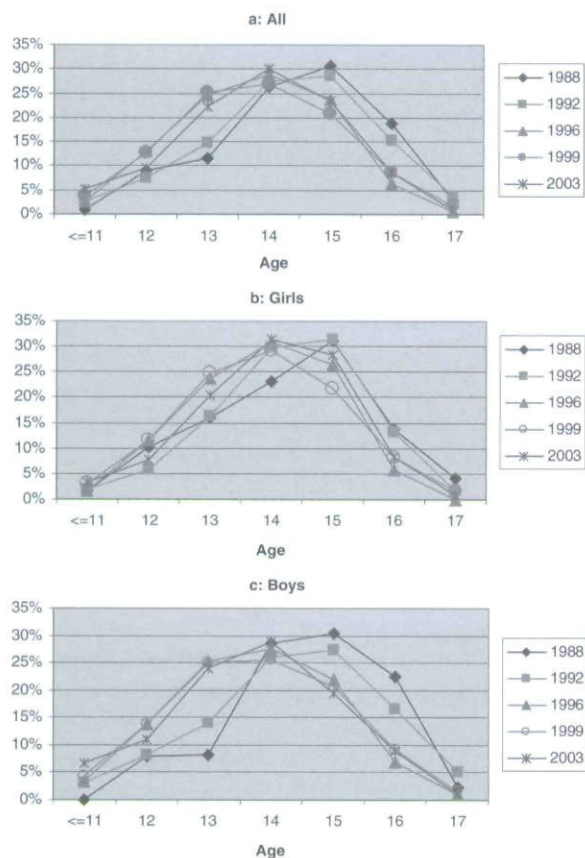
Boys and girls showed a similar trend in cumulative incidence, i.e. an increase in cannabis initiation at all ages from 1988 to 1996 and stabilization in 1999 (Fig. 1b,c). However, from 1999 to 2003, the trend for boys and girls differed; at ages 15 and 16, the cumulative incidence rates increased among the girls, but not among the boys. A comparison of the results for boys and girls in the same wave shows that in 1988, onset rates were very similar (significant difference only at age 16). In 1992, 1996 and 1999 boys had significantly higher onset rates than girls (except at age 11 years). In 2003, the onset rates for boys were significantly higher at the younger ages, but not among the 15-, 16- and 17-year-olds.

#### Age of onset among life-time cannabis users from 1988 to 2003

Differences in the cumulative incidence at age 17 across the waves make it difficult to estimate and test the size of the age-shift using the results of Fig. 1. Therefore, a second set of analyses was performed, including only those respondents who had used cannabis at least once in their life (life-time users), thus excluding the effect of the differences in cumulative incidences.

Figure 2 shows the distribution of age of onset among life-time users of cannabis in each of the five waves.





**Figure 2** Age (in years) of first cannabis use among life-time users in 1988, 1992, 1996, 1999 and 2003. (a) All students; (b) girls; (c) boys (%)

Comparing the consecutive years by means of linear regression showed that 1996 differed significantly from 1992 ( $b = -0.53$ ;  $t = -5.46$ ;  $P < 0.001$ ) (Fig. 2a: all students). The differences between 1992 versus 1988, 1999 versus 1996 and 2003 versus 1999 were not significant. From a visual inspection it can be concluded that there is a clear distinction in age of first cannabis use in 1988 and 1992, on one hand, and 1996, 1999 and 2003 on the other hand: the curves of 1988 and 1992 largely overlap, peaking at age 15, while the curves of 1996, 1999 and 2003, which also overlap, show a peak at the age of 14. This difference is confirmed by the results of the linear regression model: the relationship between year of study, 1988/1992 versus 1996/1999/2003, and age of first cannabis use was highly significant ( $b = -0.53$ ;  $t = -7.11$ ;  $P < 0.001$ ). In other words, in the later years (1996, 1999 and 2003) relatively more cannabis users started using at a younger age compared to previous years (1988 and 1992). This difference in age of onset is further underscored by the fact that in 2003, 37% of the cannabis users had started at age 13 or younger, while in 1988 only 21% had started at that age (percentages were 42 in 1999, 40 in 1996 and 25 in 1992).

Figure 2b,c shows that the overall shift to lower ages of first cannabis use from 1992 to 1996 is observed for both boys and girls. For both sexes, the peak shifts from age 15 years in 1988 and 1992 to age 14 years in 1996, 1999 and 2003. Linear regression models for each of the five survey years showed that in 2003 boys and girls differed significantly in age of first cannabis use, with relatively more boys starting at a younger age. This is further illustrated by the fact that in 2003, 41% of the boys versus 31% of the girls had started at age 13 or younger.

## DISCUSSION

### Limitations

Potential limitations of this study include the reliance on self-report data. First, responses to sensitive questions about undesirable or illegal behaviour may be biased. However, the administration of the questionnaires in school classes and assuring anonymity, as was carried out in this study, may have helped to generate reliable and valid data (Smit *et al.* 2002). Furthermore, the potential bias of this factor may be less marked in the Netherlands than in other countries, because cannabis use is not illegal. Secondly, the study is based on retrospective data. Engels *et al.* (1997) showed that the reliability of answers to questions on age of first tobacco or alcohol use could be questioned. However, Johnston & Mott (2001) showed that reports on age of cannabis use were more reliable than responses concerning age of first alcohol or tobacco use. The authors expect recall bias to be only a minor problem in the present study, because respondents in this sample are young and the events questioned have taken place relatively recently. In addition, it is known that people tend to telescope events from the past. Because the time elapsed after the event (first cannabis use) will be longer for those who started at a younger age, the shift in age of first cannabis use as found in this study would probably be even more pronounced.

There are some limitations with respect to the representativeness of the sample. First, a consequence of conducting a school survey is that truants and those who are often ill are likely to be partially missed. Because truancy is associated positively with substance use, underrepresentation of truants in the sample will result in an underestimation of the prevalence rates (Smit *et al.* 2002) and possibly in an overestimation of the age of first use. However, the resulting bias is expected to be small, because the number of truants in this study is also small (e.g. 0.6% in 2003). Secondly, in the Netherlands school attendance is compulsory until age 16, so that the older age group in this study is not representative of the Dutch adolescent population overall, but skewed towards students from pre-university schools. However,



as this study is based on a comparison of different waves, where any influence of potential biases was operating in a similar fashion across samples, it is unlikely that any of the biases discussed above had much effect on the conclusions of this study. Furthermore, the sampling method used in 2003 was somewhat different from the previous waves. However, all samples were weighted in order to obtain maximum representativeness. Besides, the interesting changes in age of first cannabis use took place in the period 1988–96 when sampling methods were similar.

### Key results

With these limitations in mind, this study has largely confirmed the expectation that the increase in cannabis use from 1988 to 1996 was paralleled by a decrease in the age of first cannabis use, although prevalence increased most from 1988 to 1992 while age of first cannabis use decreased mainly during the period 1992–96. The downward shift was substantial: the percentage of cannabis users starting at age 13 or younger almost doubled, from 21% in 1988 to 40% in 1996. The results of this study further showed that the change to a stable age of first cannabis use, starting in 1996, paralleled the stabilization in cannabis prevalence rates. This break in the age of first cannabis use trend also coincided with the raising of the legal age for buying cannabis in coffee shops in 1996. The trend in age of first cannabis use was similar for boys and girls, although in 2003 relatively more boys than girls started at an early age.

The ESPAD survey showed that in the United Kingdom, almost no change in the percentage of students starting cannabis use at age 13 years or younger was observed (14% among students aged 15 and 16 in 1995 and 1999 and 13% in 2003) (Hibell *et al.* 2004). Using survey data from Germany (conducted in 1995, 1997 and 2000), Greece (conducted in 1993 and 1995) and Spain (conducted in 1995, 1997 and 1999) it was concluded that these data did not indicate a shift of first cannabis experience towards younger ages (Kraus & Augustin 2002). A study in Switzerland among 15–49-year-olds found that the age of first cannabis use decreased by almost 9 months between 1992 and 1997 (Müller & Gmel 2002). Dennis *et al.* (2002) reported on data from the United States between 1954 and 1996. They found that, after an initial drop in the early 1990s, the incidence of new cannabis users started to rise again, especially in the age group under 15 years. Thus, with the exception of the United States and Switzerland, the age of first cannabis use did not decrease in the various countries where it was investigated, suggesting that country-specific changes in national policy or other factors influencing availability of cannabis modify age of

onset of first use in young people. The results of this study also seem to indicate this.

As reported by many others, boys have higher prevalence rates compared to girls (e.g. Kandel & Logan 1984; DeWit *et al.* 1997; Kosterman *et al.* 2000). However, the trends in life-time and 4-week prevalence rates in this study suggest that the gender differences are becoming smaller. On the other hand, the distribution of the age of onset among the life-time cannabis users showed that in 2003, relatively more boys than girls started using at a young age (13 years or younger). In a German study, Perkonig *et al.* (1999) observed no noticeable gender differences in cumulative prevalence for life-time cannabis use or age of first cannabis use (year of study 1996/1997). These authors concluded that the gap between males and females in rates of cannabis use might be closing slowly due to increased rates of cannabis use among female adolescents.

The changes in the age of first cannabis use between waves may be the result of several interrelated factors. It is possible that changes in demographic factors partly explain the observed trends. From the most relevant demographic factors—age, gender and ethnic composition—only the latter may have influenced the results (effects of age and gender were taken into account). A comparison of the ethnic composition of the samples showed that the percentage of Moroccan and Turkish students increased from 1992 to 1996. However, this would have had an upward effect on the age of first cannabis use, as Moroccan and Turkish students have a higher age of first cannabis use than autochthonous students. In addition, the age of first use remained stable in these ethnic groups. It can therefore be concluded that it is unlikely that changes in demographic factors explain the overall trend observed in this study.

Changes in the perceived benefits or harmfulness of cannabis use, availability and price of cannabis, law enforcement and severity of punishment are other factors that may have influenced the age of first cannabis use. Drug policy is one of the instruments to influence these factors. In the Netherlands, the statutory depenalization in the late 1970s involved a major change in cannabis policy. Possession of small amounts of soft drugs for personal use was no longer pursued and the Public Prosecution stopped investigating sales of a maximum of 5 g of hash or marijuana per transaction. These changes took place many years before the start of the investigated time-span in this study and may have set off a trend towards younger age of first cannabis use, the last of which was captured in the current study in 1988. Since 1995, a number of other policy measures have been introduced which affect the availability of cannabis. These measures have probably contributed to the decrease in the number of coffee shops between 1997 (1179) and 2003 (754)



(Pardoel *et al.* 2004). This development runs parallel with a stabilization of cannabis prevalence rates among adolescents (Monshouwer *et al.* 2004). Also, in 1996 the Dutch government took action to curb the increase in cannabis use among young people, by raising the legal age for buying cannabis in 'coffee shops' from 16 to 18 years. The results show that this measure coincides with a stabilization in the age of first cannabis use. Additional *post-hoc* analyses of the data on perceived availability showed a significant increase between 1992 and 1996, in the students thinking that it would be fairly or very easy to obtain cannabis if they wanted to [the percentage rose from 24.2 (95% CI: 21.9–26.6) to 33.8 (95% CI: 31.4–36.2)]. From 1996 to 1999, the percentage dropped to 26.2 (95% CI: 24.4–28.3) and stabilized in 2003. These data suggest that drug policy has affected perceived availability and the actual use of cannabis, although any causal relationship between these factors is difficult to establish. Performing interrupted time-series analyses would allow more definite conclusions but that would need at least five observations before and five observations after the policy change (Manly 1992).

Linking changes in age of first use to changes in national policy counters Kilmer's (2002) conclusion, from an overview of studies and statistics of different countries, that cannabis policy does not appear to affect cannabis use greatly. Korf (2002) comes to a similar conclusion in a study of the relationship between coffee shops and trends in cannabis use in the Netherlands. However, as pointed out by Korf (2002), after raising the age limit in 1996 in the Netherlands students showed a higher likelihood of buying cannabis outside coffee shops, mainly from friends. Although, as Korf (2002) concludes that the policy measurement seems to have resulted in a displacement of the cannabis market, it is not certain that the share of the coffee shop in this market has been fully taken over by other suppliers. If there has not been a 100% displacement of the cannabis market, it is not unlikely to assume that raising the legal age has also affected (age of first) cannabis use. For example, young adolescents are less likely to be offered or obtain cannabis if their older 16- and 17-year-old friends are less likely to possess cannabis. However, raising the legal age may also have had a negative effect. The 16- and 17-year-olds, who would otherwise have bought their cannabis in a coffee shop, now have to turn to other buyers, thereby increasing the possibility of being offered other drugs or getting in to contact with criminality.

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